EARTHQUAKE ENGINEERING AND STRUCTURAL DYNAMICS, VOL. 26, 1283–1285 (1997)

DISCUSSION

AN APPROACH TO THE MEASUREMENT OF THE POTENTIAL STRUCTURAL DAMAGE OF EARTHQUAKE GROUND MOTIONS[1]

DISCUSSION BY HALUK SUCUOĞLU*

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Establishing a consistent relationship between the instrumental intensity and macroseismic intensity of ground motions is a very important task in earthquake engineering although it is difficult to achieve for two reasons. The first difficulty arises from the difference in information sources. Instrumental intensity is based on a precisely measured ground-motion trace at a point, whereas macroseismic intensity is based on a scaling of the effects of earthquake excitation on the habitated environment as observed by humans. The second difficulty is the scarsity of earthquake data where reliable instrumental and macroseismic information exist simultaneously.

The authors used a valuable database which include both types of intensity information obtained during various events in Italy between 1980 and 1984.[1] They introduced Arias Intensity[2] (AI) and Cumulative Absolute Velocity (CAV) for measuring the intensity, or damageability of strong motion accelerograms, and investigated the correlations of these two parameters with the MSK intensity observed in the vicinity of the associated strong-motion stations. Such an attempt is very useful since well-established strong-motion parameters have not been developed yet for providing a simple link between the intensity of strong motions and the damage they cause.

The correlations between Arias intensity and MSK, and between cumulative absolute velocity and MSK have been presented in Figures 2 and 4, respectively, for 25 stations in the discussed paper.[1] Similar correlations can also be constructed between peak ground acceleration (A) and MSK, and between peak ground velocity (V) and MSK as shown in Figures 1 and 2 below. When Figures 1 and 2 are compared with the Figures 2 and 4 in the discussed paper, the following observations can be drawn.

1. There is a general exponential trend between the instrumental intensity parameters AI, CAV, A, V and the macroseismic intensity MSK in these four figures although the associated correlations are not strong.
2. The dispersion of data in Figures 1 and 2 are less compared to the dispersion in Figures 2 and 4 in the discussed paper. Therefore, correlations between A and MSK, and between V and MSK are stronger compared to the correlations between AI and and MSK and CAV and MSK. A quantitative comparison of the coefficients of correlation in these two pairs of figures is not possible since the numerical values of AI and CAV are not available to the author.

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CCC 0098–8847/97/121283–03$17·50

Received 11 March 1997

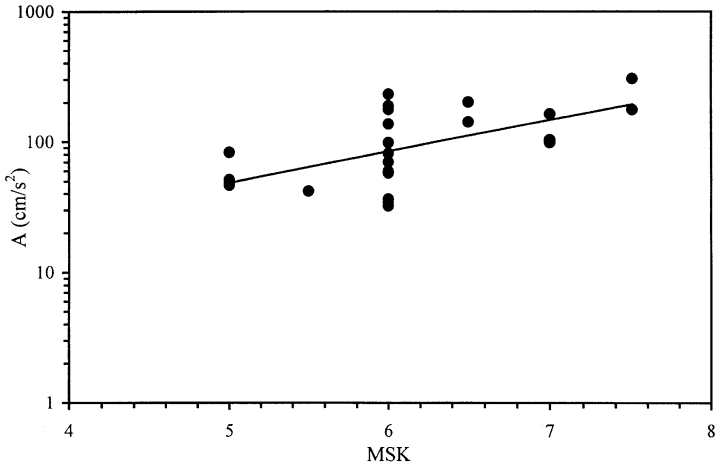

Figure 1. Correlation between the peak ground acceleration and local intensity

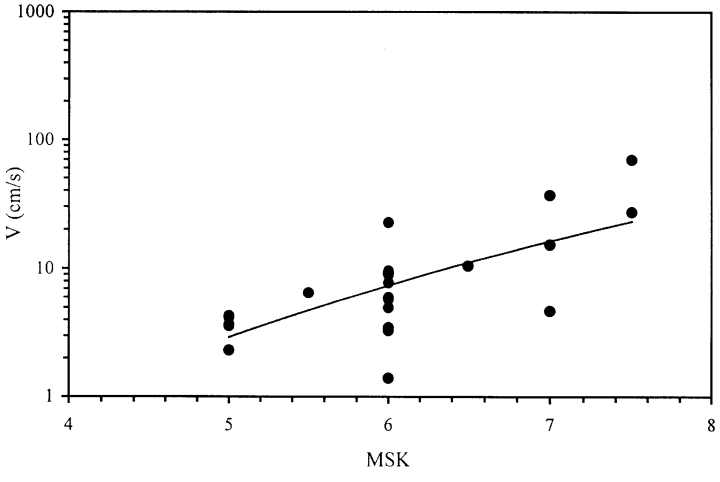

Figure 2. Correlation between the peak ground velocity and local intensity

The authors should justify in proposing AI and CAV for reflecting the damageability of strong motions in favour of A and V, since the latter two parameters of a strong motion can be obtained much more easily than AI and CAV. Besides, it is known that Arias intensity has a weak correlation with the total energy fed into vibrating systems during a seismic excitation.[3] Existence of a severe acceleration pulse in a ground-motion record plays a dominant role in its damage potential, suppressing the importance of duration and frequency content. This characteristic is well represented by the peak ground velocity, V.

A last comment is on the ENEA–ENEL data presented in Reference 1. It is reported in Table II that the Umbertide strong-motion record has a peak acceleration of $36{\cdot}5\ \mathrm{cm\,s^{-2}}$ and a peak velocity of $1{\cdot}4\ \mathrm{m\,s^{-1}}$, causing an MSK intensity of 6 in the vicinity of the recording station. These values are contradictory, because such a weak motion with almost an imperceptible ground velocity cannot lead to moderate damage even in rural structures as indicated in Table III.

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